WE CLAIM:

1. A gas turbine engine comprising:

a compressor and a turbine in serial fluid communication;

a rotatable load;

a differential gearing system for receiving power from the turbine and transmitting power to the compressor and the rotatable load;

a first motor/generator mechanism coupled to the compressor for operating either as a motor to drive the compressor, or as a generator to take power from the compressor;

a second motor/generator mechanism coupled to the rotatable load for operating either as a motor to drive the rotatable load, or as a generator to take power from the rotatable load; and

the first and second motor/generator mechanisms being adapted for selectively modulating the torque versus speed characteristics of the compressor and the rotatable load, and for modulating the rotational speed relationship between the turbine, compressor and the rotatable load.

2. A gas turbine engine according to claim 1, wherein the differential gearing system comprises:

a first sun gear driven by the turbine at turbine rotational speed;

epicyclic gearing engaging the first sun gear and operatively connected to the compressor for rotationally driving the compressor at a first

output rotational speed with respect to the turbine; and

an epicyclic carrier for operatively supporting the epicyclic gearing and being rotatable together with the epicyclic gearing, the epicyclic carrier being operatively connected to the rotatable load for driving the rotatable load in rotational motion at a second output rotational speed with respect to the turbine.

3. A gas turbine engine according to claim 2, wherein the epicyclic gearing comprises a plurality of first epicyclic gears engaging the first sun gear, and a plurality of second epicyclic gears co-axially coupled with the respective first epicyclic gears and operatively connected to the compressor.

4. A gas turbine engine according to claim 3, wherein the epicyclic gearing further comprises a second sun gear engaging the second epicyclic gears and being coupled with a compressor shaft for driving the compressor.

5. A gas turbine engine according to claim 2, wherein the epicyclic carrier comprises a cylindrical section co-axially coupled with a rotatable load shaft for driving the rotatable load.

6. A gas turbine engine according to claim 1, wherein the first and second motor/generator mechanisms comprise first and second permanent magnet motor/generators, respectively.

7. A gas turbine engine according to claim 6, wherein the first permanent motor/generator comprises a stator supported on a stationary structure of the engine and a rotor co-axially coupled with a compressor shaft, and the second permanent magnet motor/generator comprises a stator supported on a stationary structure of the engine and a rotor co-axially coupled with either a rotatable load shaft or a cylindrical section of the planet carrier.

8. A gas turbine engine according to claim 7, wherein the stator of each of the first and second permanent magnet motor/generators comprises a winding electrically connected to the controlling means.

9. A method for controllably distributing power from a turbine of a gas turbine engine between two rotatable loads of the gas turbine engine, comprising:

transferring a shaft power of the turbine to the respective rotatable loads using differential gearing operatively coupled with the turbine and the rotatable loads, respectively ; and

controlling the power transfer using machines operatively coupled with the respective rotatable loads, operable as a generator or a motor for selectively taking power from one of the rotatable loads to drive the other of the rotatable loads, or the reverse.

10. A method according to claim 9, wherein the controlling step comprises:

operating the machine coupled with the compressor as a generator and the machine coupled with the

rotatable load as a motor, to increase the rotation speed of the rotatable load.

11. A method according to claim 9, wherein the controlling step comprises:

operating the machine coupled with the compressor as a motor and the machine coupled with the rotatable load as a generator, to increase the rotation speed of the compressor.

12. A gas turbine engine comprising:

a compressor and a turbine in serial fluid communication;

a rotatable load;

a differential gearing system for receiving power from the turbine and transmitting power to the compressor and the rotatable load;

a first power means coupled to the compressor for one of driving the compressor and taking power from the compressor;

a second power means coupled to the rotatable load for one of driving the compressor and taking power from the rotatable load; and

the first and second power means being adapted for selectively modulating the torque versus speed characteristics of the compressor and the rotatable load, and for modulating the rotational speed relationship between the turbine, compressor and the rotatable load.